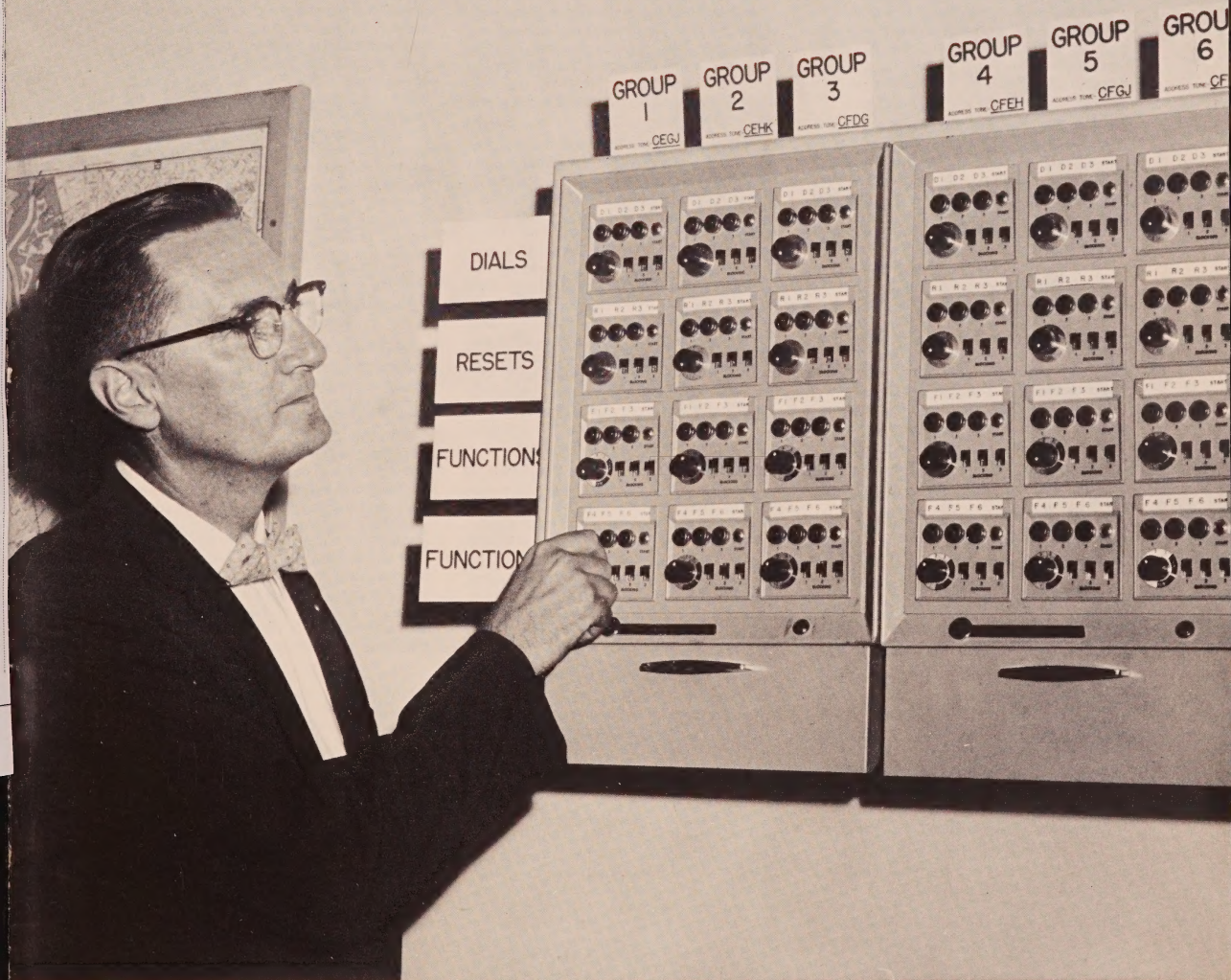




MOTOROLA

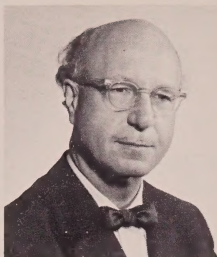
newsgram

Vol. 16 - No. 3



In this issue . . .

Control of a good-sized portion of street traffic in the nation's capital is literally at the fingertips of persons operating this Master indication and manual control which is a vital part of the Motorola Radio Traffic Light Control System installed in Washington, D. C.



Mesa Transistor Transmitters

I have been talking about the mesa transistor as a potentially important r.f. power source for so long that I thought it would be a good idea to demonstrate its VHF power capability. At the Denver APCO meeting August 4, I enjoyed the privilege of telling the group about the Motorola parametric amplifiers, circulators, and mesa transistors, and I demonstrated the new Motorola r.f. power mesa transistors. My transistor oscillator delivered an output of approximately $\frac{3}{4}$ Watt of r.f. power at 200 megacycles.

For the benefit of the readers who are not familiar with the mesa design, I might explain that the transistor working area consists of a tiny plateau etched on a .025" square slab of germanium. The mesa or plateau area which carries the working portion of the mesa is so small that it can be completely covered by a tiny piece of human hair about .007" long. The emitter and base connection parts of the transistor are aluminum and gold strips, each about .006" long by .001" wide, and separated by .0005". In Motorola's production operation, 144 sets of aluminum and gold strips are simultaneously evaporated on a germanium diffused base slab about $\frac{3}{8}$ " square. Later, this slab breaks into 144 single transistor units. As I suggested, the active portion of the transistor is only a little more than .006" x .003" in size. Of course, it is very difficult to handle such a speck of material, but as you know, in our art we must "think small" because the size of an r.f. device always shrinks as the frequency goes up.

We have made units which operate as high as 1500 Mc., and although the output of our power units at 200 Mc. is a bit less than 1 Watt at present, I think I can safely predict that some day outputs as high as 15 or 20 Watts will be possible. The precision quality Motorola mesa transistor is still a high-priced, specialized device, but eventually the price will drop as mass production methods mature, and when the price permits, high quality portable and mobile equipments will all use mesa transistors.

Parametric Amplifiers Can Improve Mobile Systems Design

My talk at the convention included a brief story about the Motorola parametric amplifier. This amplifier consists of two resonant coaxial line cavities capacitively coupled by a semiconductor diode. One cavity is a signal cavity and the other one the idler cavity, with a diode between made to vary its reactance with the application of a high frequency signal, usually referred to as a "pump signal." The pump frequency signal is

equal to the sum of the resonant frequencies of the two tank circuits. The signal power and pump power mix in the non-linear coupling diode to produce sidebands. Since the cavities are resonant, the idler cavity responds only to the lower sideband or difference frequency. Power at the idler frequency then mixes with the pump power to produce a signal of the original frequency. This generated signal is in phase with the original signal, and amplification results, obviously because the sum of the two signals in phase is greater than the original signal.

I have described the typical operation of a regenerative-type parametric amplifier. Since the parametric amplifier is *not* a resistance device and does not utilize a cathode or an electron beam, the noise generated is very low. The Motorola parametric amplifier has a stable gain of about 16 db. and 1 Mc. bandwidth at 220 Mc., with a noise figure of approximately 1.5 db. A distinguishing feature of this amplifier is the very low pump power of about one-half of a milliwatt. We have other amplifiers working in the 450 Mc. band. For low noise level 450 Mc. base station locations, the parametric amplifier can substantially improve the talk-back reception from the mobile units.

You note that I have avoided the mention of 150 Mc. systems for parametric amplifier applications. Recently I have been examining some of the published data on suburban area ambient noise levels, including cosmic noise levels, and I have been disappointed to find that the inherent noise is rather high for 150 Mc. and below. I suspect that the published data indicates higher noise levels than actually exist, but even with the correction based upon our experience with $\frac{1}{2}$ and $\frac{1}{4}$ microvolt signals in mobile systems, it still appears to be true that the cost of parametric amplifiers and their complication would probably not justify their use for the comparatively small improvement which could be achieved at 150 Mc. 450 Mc. is a different matter, and it is probable that a 2 or 3-times power gain could be realized for these higher frequency systems. The parametric amplifier is still of great interest to us because it is highly probable that we shall be operating mobile systems in the band all the way up to 890 Mc. Let's take another look at it.

As One Layman to Another

Now, if you haven't understood the principle of operation of the parametric amplifier, perhaps an analogy will clarify the concept. Since I am a layman in this specific field, perhaps as one layman to

another I can transmit successfully an over-simplification of the basic parametric amplifier idea. This is a simplification of the pendulum analogy. Assume that a pendulum is swinging continuously at a constant amplitude. This will be the original signal input into the parametric amplifier. Now, if we introduce another source of energy (the pump signal) in proper phase, we could give the pendulum a push so that its amplitude would be increased beyond that for its original excursion. So long as each push was properly synchronized, the amplitude of the swing would be increased. From this analogy, it would seem that by the addition of the properly synchronized push (the pump signal), we have increased the amplitude of the original pendulum excursion without changing its frequency, and we have in effect produced amplification. This is crude and incomplete, but it may help you to understand.

Low Ambient Noise the Key to Application Success

Now that we are all experts on the theory of parametric amplifiers, let me go on to say that the amplifiers now in use are units with high-Q cavities and rather narrow bandwidth (1 Mc. bandwidth for 220 Mc. carrier). They are perfectly suited to applications in mobile and other radio communications systems, but they are not suitable for TV reception and other wideband applications. Although parametric amplifiers are expensive, they are potentially the cheapest way to increase the equivalent power of a dozen 450 Mc. mobile units in a particular system by a factor of two or three times, or even more, depending upon the characteristics of the system, without changing the mobile units.

The use of parametric amplifiers points up my often repeated statement that the *ambient noise* at the base station receiving antenna is a very important systems design factor. If the noise is low, you can use low noise level amplifiers to increase the effectiveness of the mobile talk-back, but if the ambient noise is high, you are throwing costly mobile transmitter power down the drain of irresponsible systems design, and no r.f. amplifier at the base station, no matter how good the noise characteristics, will improve the reception from the mobile units.

Dan Noble

MOTOROLA

newsgram



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MOTOROLA ACQUIRES DAHLBERG COMPANY

Motorola Inc. recently acquired the Dahlberg Company of Minneapolis, Minnesota, the fourth largest producer of hearing aids in the United States.

The Dahlberg firm, founded in 1948 by Kenneth and Arnold Dahlberg, was the first to use transistors in a consumer product, and was among the first to market an all-transistor hearing aid. The Dahlberg Company is also a major producer of specialized hospital communications equipment.

In making the acquisition announcement in Minneapolis, Robert W. Galvin, President of Motorola Inc., said the Dahlberg Company offers Motorola the opportunity to further increase its diversification of electronic prod-



Kenneth H. Dahlberg



Arnold R. Dahlberg

ucts, acquire additional young and aggressive management and to open another line of products demanding micro-miniaturization of electronic circuitry.

The present executives and personnel of the Dahlberg companies will continue as before the acquisition. The Board of Directors of this new subsidiary will be comprised of the Dahlberg brothers and three Motorola executives. »

SEMICONDUCTOR PLANT OPENED IN PHOENIX

Activation of the new Semiconductor plant in Phoenix, Arizona has added impressive facilities to the ever-expanding network of plants.

The new 129,000 square foot building provides more than five times the production facilities for the Motorola Mesa transistor and allows room for a three-fold expansion of all other current Motorola product lines. The structure represents an investment of approximately three million dollars in building and facilities.

An estimated 2,000 guests, including Governor Paul Fannin of Arizona attended the dedication ceremonies. Dr. Daniel E. Noble, Executive Vice President in charge of Motorola's Semiconductor, Military Electronics and Communications and Industrial Electronics Divisions told the guests: "The opening of this facility is only the beginning of a growth pattern and will add substantially to Motorola electronic operations in Arizona."

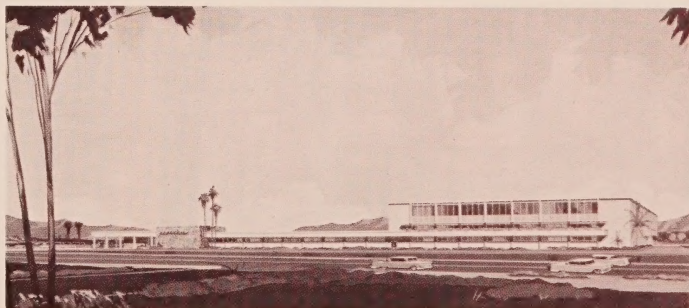
The building is unique in that it is the first post-tensioned grid

type structure ever built and represents the first time post-tensioned grid floors of this nature were raised into place.

The first floor of the building is devoted primarily to laboratories, mechanical facilities and office area. The second of the three floors is primarily a service area and devoted almost entirely to facilities servicing the production areas. A honeycomb of tubing to carry the argon, hydrogen and nitrogen gases to production areas as well as complete air condition-

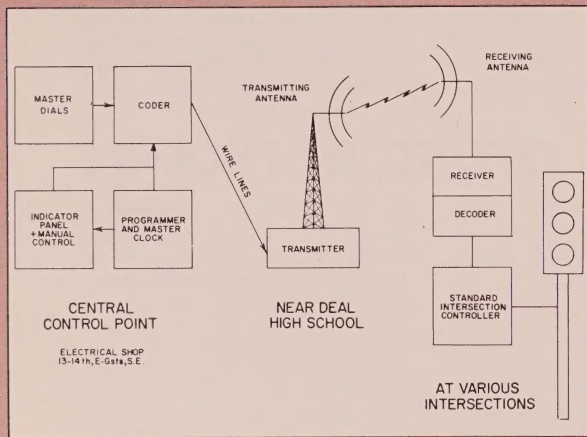
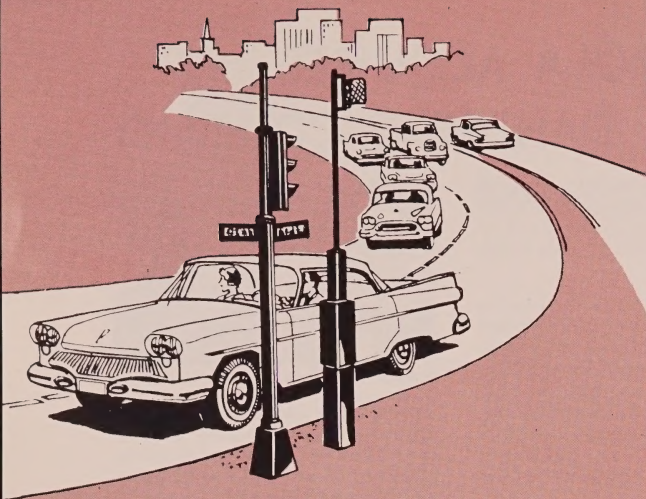
ing equipment and other major service facilities for the building occupy the majority of the floor. The third floor is devoted exclusively to production areas.

Dr. Noble pointed out that, while the new addition adds something in excess of 100,000 square feet of actual manufacturing area to the present facility, this is only the first step in an anticipated Division expansion which will provide more than ½ million square feet of work space at the Semiconductor plant. » » »

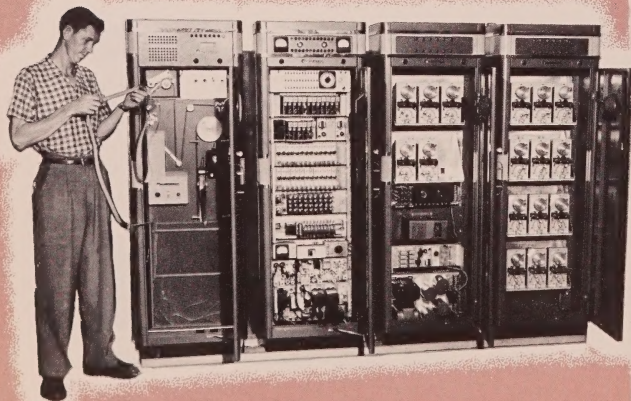


Sketch of Motorola's Semiconductor plant showing recently-completed three-story addition.

RADIO CONTROLS TRAFFIC IN THE NATION'S



Block diagram of Washington's Motorola Radio Traffic Light Control system. Equipment at central control point is duplicated in a second location to provide complete stand-by protection.



The world's largest Radio Traffic Light Control System is now "on-the-air".

In a brief ceremony held recently in the nation's capital, Brig. Gen. A. C. Welling, Engineer-Commissioner, District of Columbia, officially turned on the Motorola System that eventually will control all of Washington's 1000 signallized intersections.

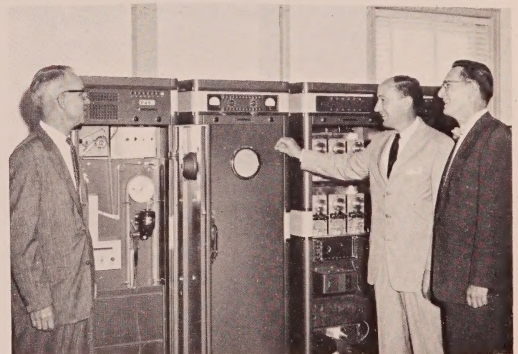
Traffic signals standing by themselves serve but one major purpose—prevention of accidents. But when individual intersections served by such signals are integrated into a *system*, they also become a means of moving traffic efficiently.

Interconnecting the signals permits synchronization so that vehicles moving at specified speeds along a certain route could ostensibly go from one end of the signal-controlled street to the other without ever hitting a "stop" signal.

Such control also provides regulation so that proportion of main street to side street "green" time can be changed throughout the day and week to accommodate changing peak traffic flow patterns.

In Washington, approximately 600 intersections in the downtown area are connected by cable. Extending this underground system to the signallized intersections in the outlying district would be economically unfeasible.

Washington, however, found a ready solution to this problem in a new Motorola system which utilized UHF radio to tie outlying signals to a complex control center. Motorola "radio control" provides



Brig. General A. C. Welling, Engineer—Commissioner for District of Columbia flips the switch that officially puts the Washington, D. C. Motorola Traffic Control System "on the air". Watching are Harold Aitken, Director of Highways (left) and Francis Twiss, Deputy Director of Traffic and Operations.

Technician examines punched tape program at the central control station, the nucleus of Washington's Radio Traffic Light Control system. Equipment at the central station includes punched tape programmer, coder, and two cabinets of master dials used in synchronizing traffic signals.

TRAFFIC CONTROL'S CAPITAL



the means of synchronizing and regulating not only the radio-connected intersections, but also the older cable-connected network.

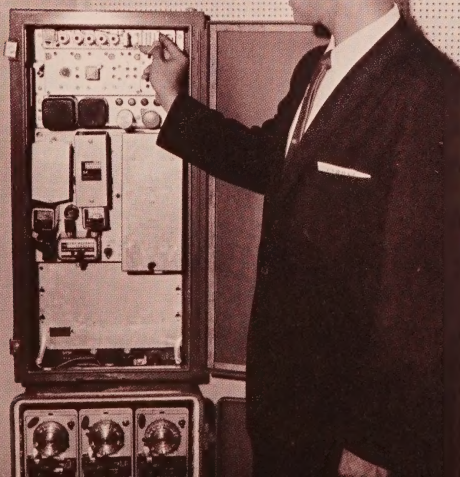
The new Motorola control station includes a high speed, high capacity punched tape programmer and master clock; a tone generating coder; master dial synchronization devices; an indication and manual control panel, and the UHF radio base station.

Working from extensive surveys, Washington traffic engineers are able to accurately predict traffic volume and flow for various times of the day and week. A program to facilitate traffic movement at all times is prepared from these studies and punched on paper tape. Information from this punched tape program is fed into the coder unit which translates it into audio tone signals. These are broadcast throughout the radio and cable system.

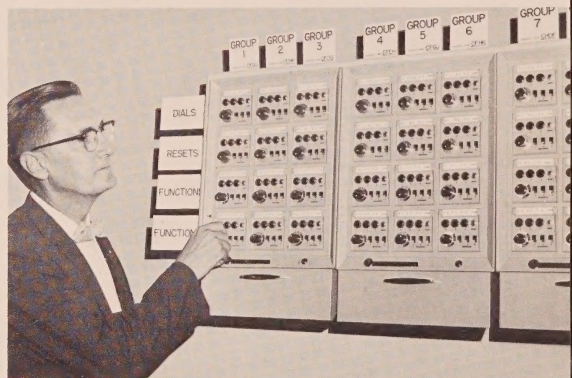
Other tone codes which keep the signals through the system in synchronization are also generated and transmitted by the system.

At the radio-controlled intersections in the Motorola system are receiver-decoder units which pick up the signals, decode the tones, and when applicable, feed the information to the traffic signal controllers. In the initial Washington system are 87 such units which control 127 intersections. Another 75 receiver-decoders are scheduled for installation late in 1959. It is planned to extend the system until all signalized intersections in the District are under radio control. » » »

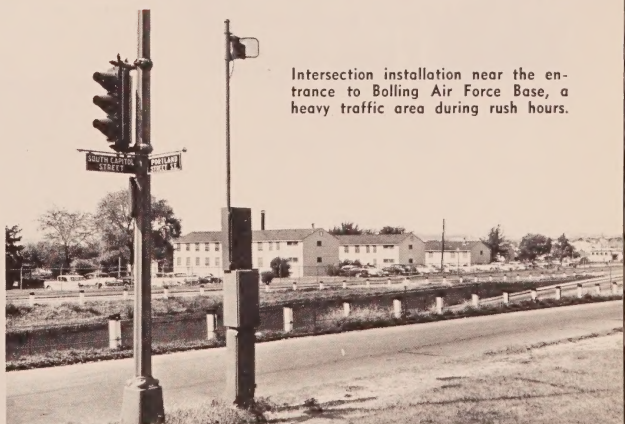
Receiver-decoder units like those located at all Washington radio-controlled intersections. Engineer is pointing out a tuned cavity in the completely transistorized radio receiver.



Special traffic programs can easily be substituted through the simple expediency of loosening two screws and removing the readout frame from the programmer console. The tape shown includes a program of light cycle changes which are fed into the coder.



Master indication and manual control panel shows the program in effect at all times. Should the need arise, automatic program can be taken over by manual control. Modular construction of master control panel makes it easy to add components.



Intersection installation near the entrance to Bolling Air Force Base, a heavy traffic area during rush hours.

TRANSMISSIONS ON MOTOROLA PERSONNEL

CHARLES HERRIN has been named sales manager, 2-way radio products, for Motorola Communications & Electronics, Inc., for the 10 state Western area consisting of Washington, Oregon, California, Idaho, Nevada, Wyoming, Montana, Colorado, Utah and Arizona.

Herrin, with Motorola the past six years, has been an account executive in this area since April of 1958. He had been appointed a zone manager in 1956.

In his new capacity, Herrin will coordinate sale of 2-way mobile and portable radio equipment in the five sales regions contained within the area. Herrin's office

is to be located at 1616 Rollins Road, Burlingame, California, the Motorola Western area sales and service headquarters.

WILLIS DITMANSON has been named National Parts and Service Manager of Motorola Communications and Electronics, Inc. Ditmanson was formerly Manager of the Midwest Area Parts Depot. In his new position, Ditmanson is responsible for incorporating activities of the service organization on a national basis. He also retains responsibility for the National Parts Department serving the various Area Parts Depots. His office is at 4501 West Augusta Blvd., Chicago, Illinois.

JOHN TANSEY has joined Area 1 as Western Area Service Manager. Tansey has been with Motorola for more than seven years, both as Chicago Parts and Service Manager and as National Service Manager.

TED LUESING, formerly Western Area Service Manager, has transferred to the sales force and is now Zone Manager in Denver.

GEORGE FUNKEY, in addition to his responsibilities as Paging Manager in Area 1 has been assigned additional duties as manager of closed circuit television sales in his area. » » »

MOTOROLA INTRODUCES CCTV EQUIPMENT

Motorola has entered the closed circuit television field and has introduced a line of equipment which will be available in the last quarter of this year.

The Motorola line includes five cameras, two monitors and necessary accessories for complete system design in industrial, commercial, educational, and governmental applications. Cameras include four general purpose units and one view finder studio model. These cameras can be adapted to include pan and tilt, remote turret and iris control, remote optical focus, remote zoom lens

and other similar applications.

The view finder camera has a rear control four lens turret, side focusing independent view finder control and other features that make it ideal for studio use and the more elaborate training and educational systems.

The two receivers in the basic Motorola line include a high-quality closed circuit industrial monitor with a 14" screen and a 21" unit capable of receiving standard VHF or UHF TV broadcast signals, as well as closed circuit transmission. » » »



Televised views of Bob Galvin, President of Motorola Inc., (left), and Art Reese, a Vice President of Motorola Inc., are shown on two Motorola "Classroom 21" educational television receivers as a feature of a meeting at which the new Motorola line of closed circuit television equipment was introduced. Standing adjacent to this equipment and acting as moderator for the meeting is Homer Marrs, Vice President and Operations Manager for Motorola Communications and Electronics, Inc.



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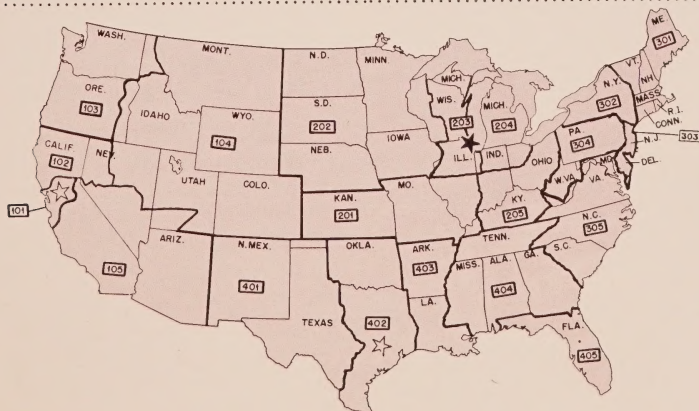
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